(No Model.) 3 Sheets—Sheet 1.

T. A. B. CARVER.

JACQUARD MECHANISM FOR LOOMS.

No. 604,299. Patented May 17, 1898.

Fig. 1.

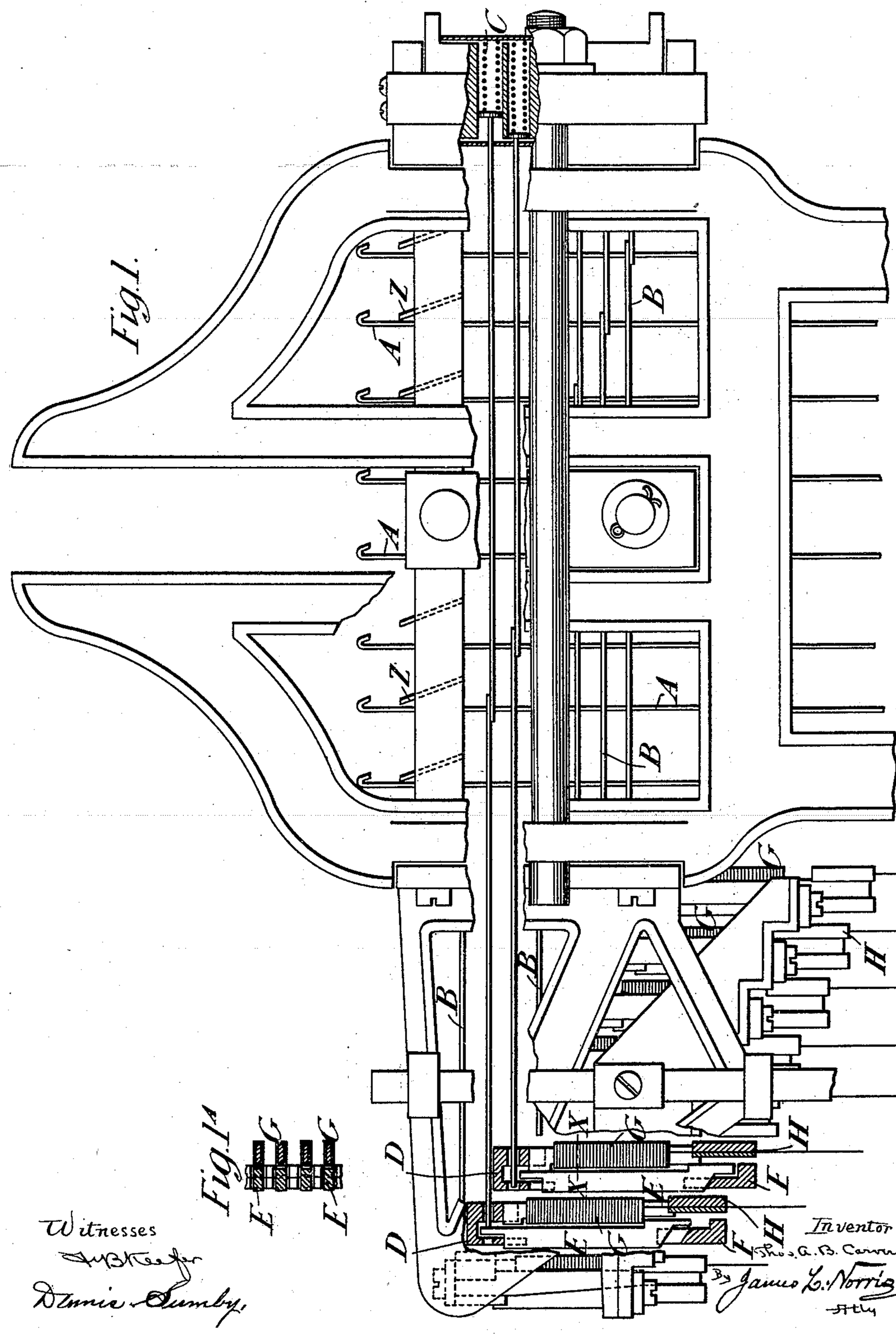


Fig. 1a.

Witnesses
A. B. Carver
Dennie Sumby.

Inventor
Thos. A. B. Carver
By James L. Norris.
Atty

(No Model.) 3 Sheets—Sheet 2.

T. A. B. CARVER.

JACQUARD MECHANISM FOR LOOMS.

No. 604,299. Patented May 17, 1898.

Fig. 2.

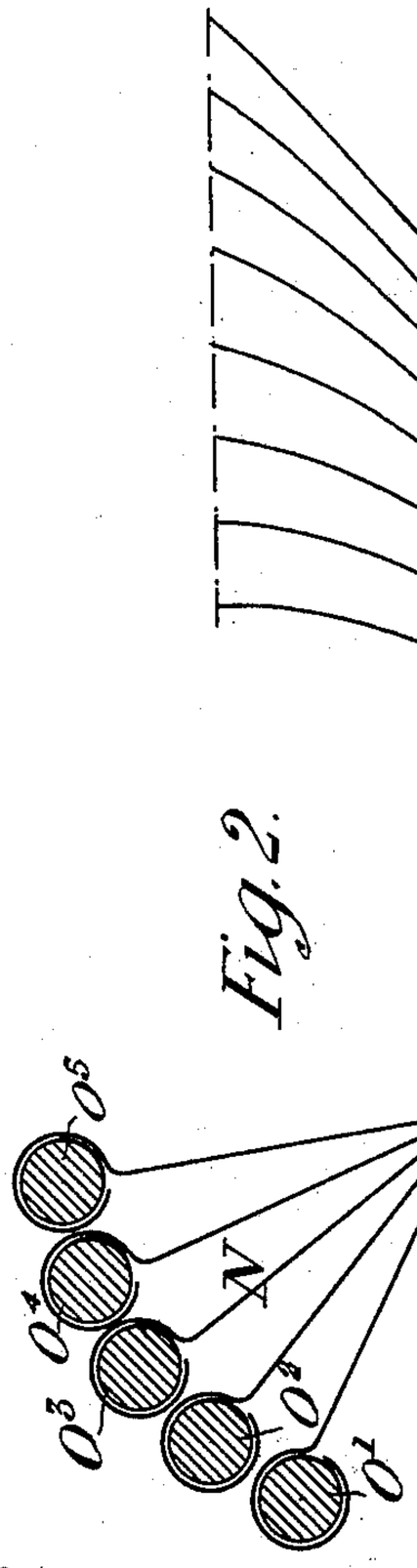


Fig. 2a.

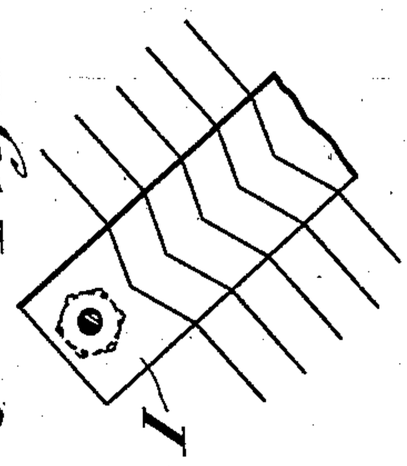
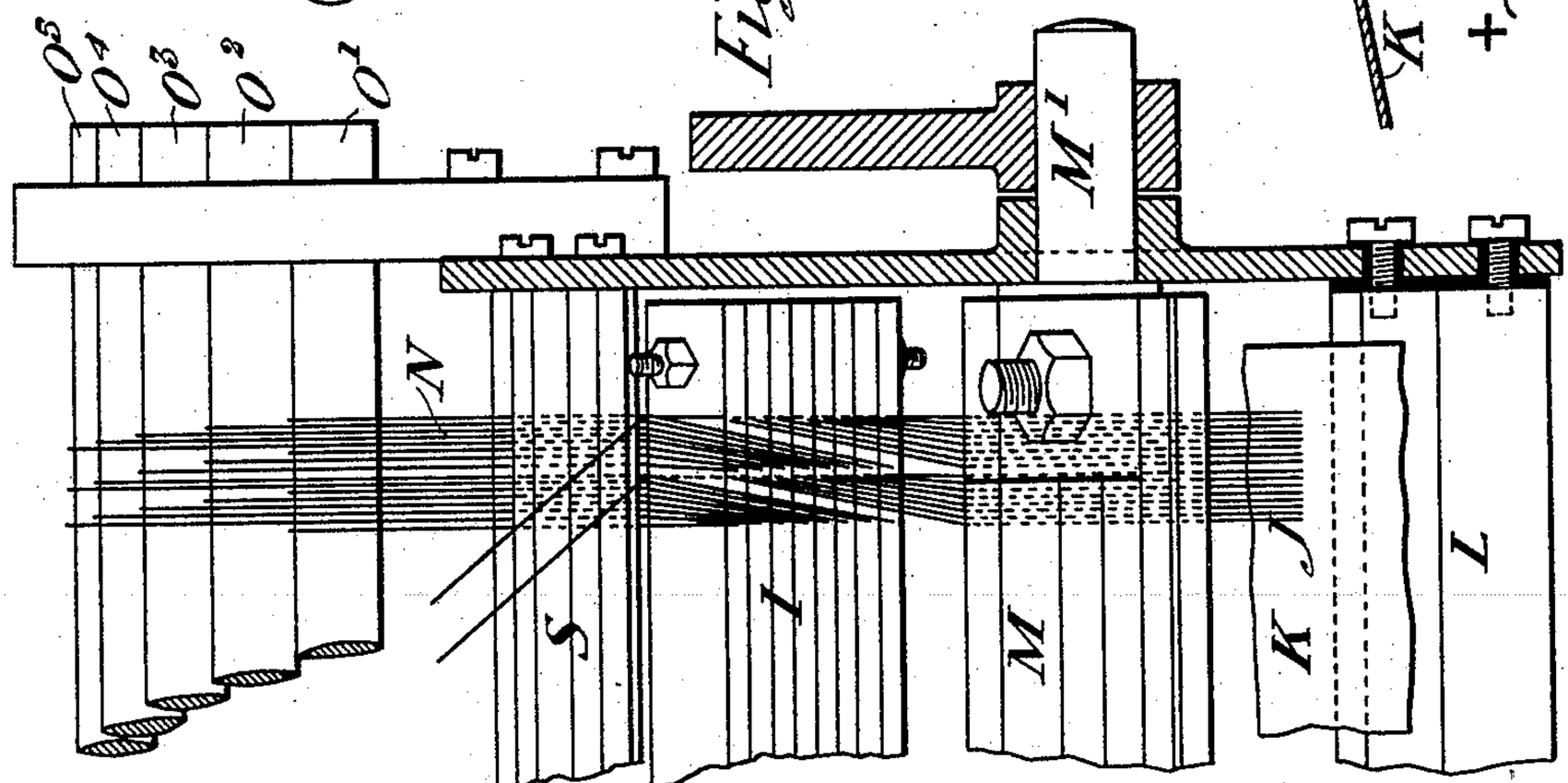


Fig. 3.



Witnesses
A. B. Taylor
Dennis Sunby.

Inventor
Thomas A. B. Carver
By James L. Norris
Atty

(No Model.) 3 Sheets—Sheet 3.

T. A. B. CARVER.

JACQUARD MECHANISM FOR LOOMS.

No. 604,299. Patented May 17, 1898.

Fig. 4.

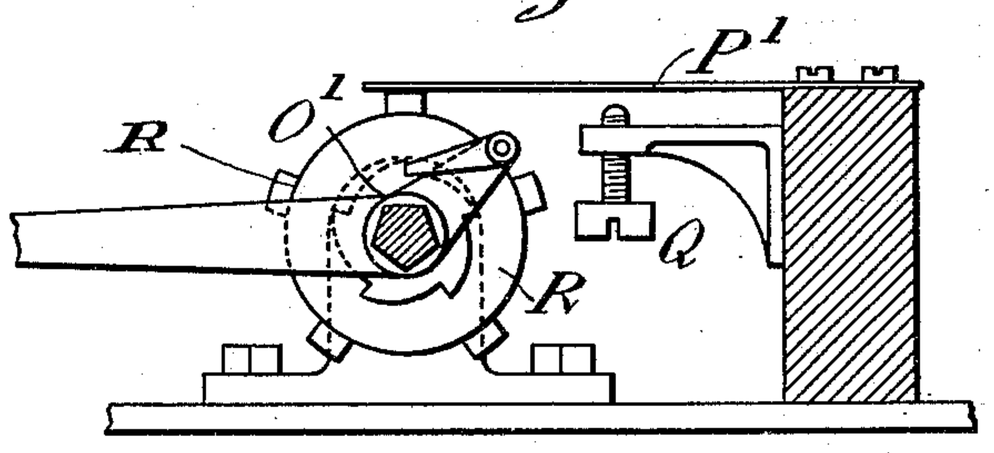


Fig. 5.

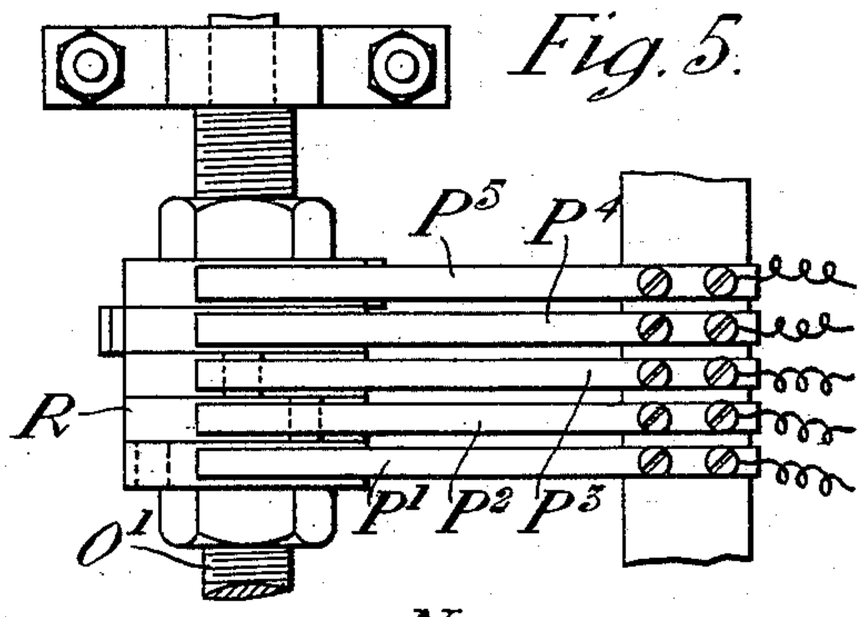


Fig. 6.

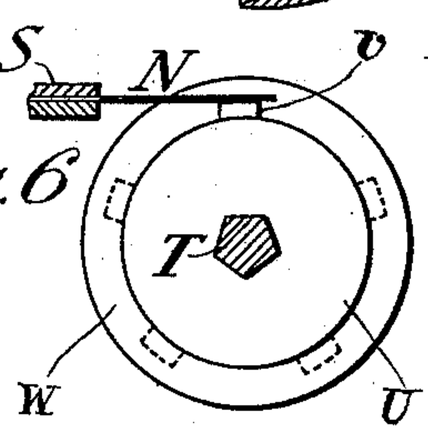


Fig. 7.

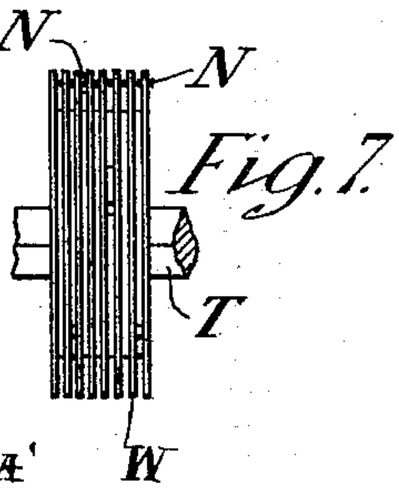
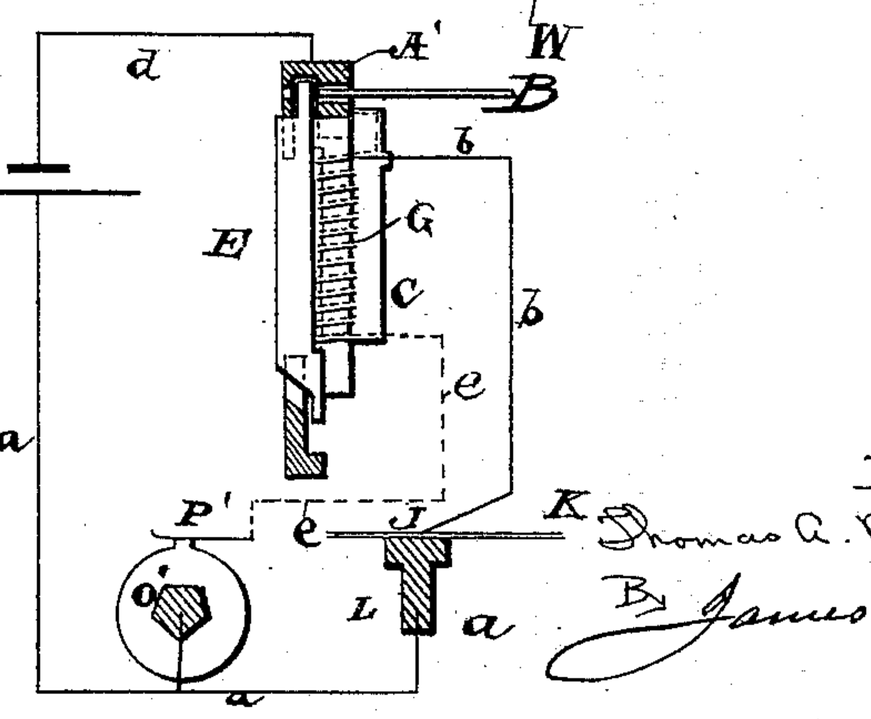


Fig. 8.



Witnesses
J. B. Keefer
Dennis Sunby.

Inventor
Thomas A. B. Carver
By James L. Norris.
Atty

UNITED STATES PATENT OFFICE.

THOMAS A. B. CARVER, OF LONDON, ENGLAND.

JACQUARD MECHANISM FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 604,299, dated May 17, 1898.

Application filed June 14, 1897. Serial No. 640,698. (No model.)

To all whom it may concern:

Be it known that I, THOMAS ALBERT BRIGGS CARVER, a citizen of England, residing at Heigham, Aubrey road, Hornsey, in the city of London, England, have invented certain new and useful Improvements in Jacquard Mechanism for Looms, of which the following is a specification.

My invention relates to improvements in jacquards of the kind in which the hooks are controlled electrically, the mechanism according to my invention being arranged for determining the twill as well as the pattern, as I shall describe, referring to the accompanying drawings.

Figure 1 is a side view of a jacquard mechanism having one set of the ordinary horizontal needles and vertical hooks with parts broken away and parts in section. Fig. 1ª is a part sectional plan on the line X X of Fig. 1. Fig. 2 is a side view of the lower part of the conducting-wires and the contact-feelers. Fig. 3 is a front view, partly in section, of the same; and Fig. 2ª is a part plan of the clamping-laths. Fig. 4 is a section, and Fig. 5 is a plan, of the twill-commutator. Fig. 6 is a transverse section, and Fig. 7 is a part side view, of a modified arrangement of commutator. Fig. 8 is a diagrammatic view illustrating the circuits through one of the magnets G.

A are the vertical hooks of the jacquard; B, the horizontal needles, which loop around the hooks A and are intermittently urged to the left and are retracted by the movable spring-box C. When a needle B is urged to the left, its left end passes through a hole in one side of an inverted-trough-shaped bar D, then through the space of the trough, and through the hole in its other side unless it is stopped by an upright keeper E being interposed in the space between the two holes at D, in which case the spring in the box C yields. The keeper E is a piece of soft iron having its upper end guided in the space of bar D and its lower end resting on a vertically-reciprocating bar F. At the side of the keeper and touching it at both ends, so as to form a closed magnetic circuit, is an electromagnet G, having a core of soft iron of rectangular section wound with a coil of insulated wire, one end of which is connected to the metal frame of the loom and the other end of which is carried down to the contact apparatus hereinafter described. The reciprocating bar F ascends and descends while the spring-box C rests. If after it has ascended, raising the keeper E, the electromagnet G is excited, so as to attract the keeper, then when the bar F descends the keeper is still kept up by the magnet's attraction, and as the needle B makes its stroke to the left it stops the needle B, which, however, by striking against the keeper detaches it from the magnet, and, the magnet being no longer excited, the keeper E, as the needle B begins to retreat to the right, drops to its former position in the frame F. If when the bar F rises the magnet G is not excited, then when the frame F descends the keeper also descends, and the needle B can then pass through the second hole at D. According as the needle B is free to move or is stopped, as described, the corresponding vertical hook A is moved to the left or is not moved, so that its hooked head is moved out of the path or left in the path of the vertically-reciprocating knife Z, the warps governed by the hooks A being thus either not raised or raised in forming the shed of the web.

Although I have shown a row of eight hooks A in one plane, this number might obviously be varied, and the numbers of such rows, one behind the other, may also be varied. I have shown in the drawings arrangements suited for fifty such rows, making in all four hundred hooks.

The coil of each of the electromagnets G has its one end connected in any convenient way to the fixed metallic frame of the machine, which is itself electrically connected to one terminal—say the — terminal—of a suitable battery or other source of electricity. The other ends of the insulated coil-wires are first led through pairs of clamping-laths H, which may be of wood, there being a pair of these laths for each row of wires from side to side—that is to say, fifty wires in each pair. From these clamping-laths all the wires are led down to another set of clamping-laths I, piled on one another, bends of the wires, as shown in Fig. 2ª, being pressed between the laths, so as to prevent the wires from shifting lengthwise. From the clamping-laths I the wires are led side by side almost close to-

gether through a clamp M, all terminating in bent ends or feelers J, which are bare of insulation and bear lightly on a pattern-sheet K, which is moved step by step over a metallic pad L, connected to the + terminal of the source of electricity, a switch being preferably interposed to break the circuit, except when the magnets have to operate. The pattern-sheet K is of thin metal of good conductivity, such as copper, which is covered with a non-conducting varnish or other coating, except where the figure of the pattern presents the bare metal. All the feelers J that at each step of the pattern-sheet happen to be bearing on the bare metal are thus put in circuit with the source of electricity, and the magnets G to which they lead are excited, while those feelers J which happen to be bearing on the non-conducting coating of the pattern-sheet are not in circuit, and consequently the electromagnets G, to which they are connected, are not excited. Thus the form of the pattern on the sheet K determines the raising or not raising of the warps connected to the vertical hooks A and so determines the reproduction of the pattern on the web.

For determining the twill of the fabric, as well as the pattern, the electromagnets G are wound with two coils, wound separately or together, but having their connections to the source of electricity so arranged (see Fig. 8) that currents in both coils neutralize each other, each magnet being capable of attracting and holding its keeper only when one of its coils is traversed by a current. From each magnet, therefore, two insulated wires are led through the clamps H and I. The wires N of the second set, being turned abruptly aside from the points where they issue from I, are passed through a clamp S and have their ends bent into circular loops encircling insulated metal bars O' O^2, &c., with which they make contact. Assuming that the twill to be made is a five-leaf twill, the number of bars O would be five, as shown. The second wires N are arranged on these bars, in this case every fifth wire being led to the same bar O—that is to say, the bar O' is encircled by the first, sixth, eleventh, &c., wires, the bar O^2 by the second, seventh, twelfth, &c., wires, and so on throughout the whole range of the secondary wires N.

Each bar O' O^2, &c., is electrically connected to one of the insulated springs P' P^2, &c., of a commutator, all these springs being insulated and bearing on insulated stops Q to roller R, made up of five disks, each having one projecting tooth R′, fixed side by side in such positions that the teeth are equally distributed around the roller, is caused to revolve step by step by means of a pawl and ratchet so worked that the roller moves a distance from each tooth to the next in every stroke of the loom, bringing at every movement a tooth to bear against and slightly raise one of the springs P' P^2, &c.

The roller R is connected to one terminal of the source of electricity, the metallic framing of the jacquard being connected to the other, so that when contact is made by a tooth of disk R with one of the springs P this puts in circuit with the source of electricity the corresponding bar O, all the wires N on that bar, and all the second coils on the magnets G with which these wires are connected, so neutralizing the effect of the coils first described, if these coils are in circuit, and exciting those magnets the first coils of which are not in circuit. The result of this is that at every stroke of the loom every fifth vertical needle that would be raised by the pattern mechanism if it acted alone is not raised, and every fifth vertical needle that is not raised by the pattern mechanism is raised by the twilling-coil, the result being the formation of a twill of the fabric.

The operation of the magnets will be readily understood on referring to Fig. 8 of the drawings, wherein is illustrated, diagrammatically, one of the magnets and its circuits. Referring to said figure, the letter B′ indicates a battery or other suitable source of electricity, from one terminal of which leads a conductor *a* to the metallic pad L, over which the pattern K travels step by step under the feelers J. When the feeler J makes contact with the metallic pad L, a circuit is established from the battery B′ over conductor *a*, pad L, feeler J, conductor *b*, through one of the coils G of the magnet, conductor *c* to the framing A′ of the machine, and by conductor *d* to the other terminal of the battery. The magnet is thus energized, holding the armature E raised. A branch from the conductor *a* leads to the axis O′ of the commutator, and thus a current passes by the spring-contact P′ and conductor *e* to the other coil of the magnet, (indicated by dotted lines,) and from the coil to the machine-framing A, and thence back to the battery by the conductor *d*. As the currents in the two coils of the magnet are opposite, they neutralize each other, rendering the magnet inert at the proper times for producing the twill, as described.

Instead of employing the commutator for groups of wires, as shown in Figs. 4 and 5, a long commutator for the individual wires N may be employed, as shown in Figs. 6 and 7. In this case a long spindle T of pentagonal section has on it a number of metallic disks U, having projecting teeth *v* like the disks R. The spindle has a step-by-step rotation, each step being one-fifth of a revolution, so as to bring the teeth of the disks successively in contact with the wires N, these wires being guided between thin disks W of insulating material interposed between the contact-disks. The spindle T being mounted in insulated bearings and connected to the + terminal of the source of electricity, at every fifth of its revolution all the fifth wires N and the coils to which they lead are put in circuit.

Although I have shown the bars O and the

commutator arranged for a five-leaf twill, obviously for other twills the numbers of the bars and commutating contacts would be suitably varied. As the mechanism for reciprocating the knives Z, the spring-box C, the bars F, or moving the pattern-sheet K, and the roller R or spindle T form no part of my invention and may be of ordinary known kind, I have not shown it in the drawings.

When the apparatus is intended to control the hooks for pattern only or for twill only, one of the magnet-coils, with its conducting connections, is dispensed with.

Having thus described the nature of this invention and the best means I know of carrying the same into practical effect, I claim—

1. In an electrically-controlled jacquard mechanism, the combination with a plurality of vertically-movable hooks, horizontal needles connected therewith and operating to throw said hooks into and out of operation to determine the pattern, and the vertically-reciprocating knife, of vertically-movable keepers arranged to be projected into the path of the needles, electromagnets, one for each keeper, arranged to attract and hold the keepers in the path of the needles, electric circuits controlling said magnets, circuit making and breaking mechanism, and a pattern-sheet for opening and closing said circuits to energize and demagnetize the said magnets and thus throw the hooks into and out of operation at predetermined intervals, substantially as described.

2. In an electrically-controlled jacquard mechanism, the combination with a plurality of vertically-movable hooks, horizontal needles connected therewith and operating to throw said hooks into and out of operation to determine the twill of the fabric, and the vertically-reciprocating knife, of vertically-movable keepers arranged to be projected into the path of the needles, electromagnets, one for each keeper, arranged to attract and hold the keepers in the path of the needles, electric circuits controlling said magnets, and a commutator constructed to make and break said circuits progressively in a predetermined order, substantially as described and for the purpose specified.

3. In an electrically-controlled jacquard mechanism, the combination with a plurality of vertically-movable hooks, horizontal needles connected therewith and operating to throw said hooks into and out of operation, and the vertically-reciprocating knife, of vertically-movable keepers arranged to be projected into the path of the needles, electromagnets, one for each keeper, arranged to be energized and hold said keepers in the path of the needles, two electric circuits for each magnet and arranged when closed to neutralize each other and demagnetize the magnet, a circuit making and breaking mechanism and a pattern-sheet for controlling said mechanism to open and close said circuits, and a commutator constructed to make and break the other circuit at predetermined intervals, substantially as described for the purpose specified.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 3d day of June, A. D. 1897.

THOMAS A. B. CARVER.

Witnesses:

OLIVER IMRAY,

JNO. P. M. MILLARD.